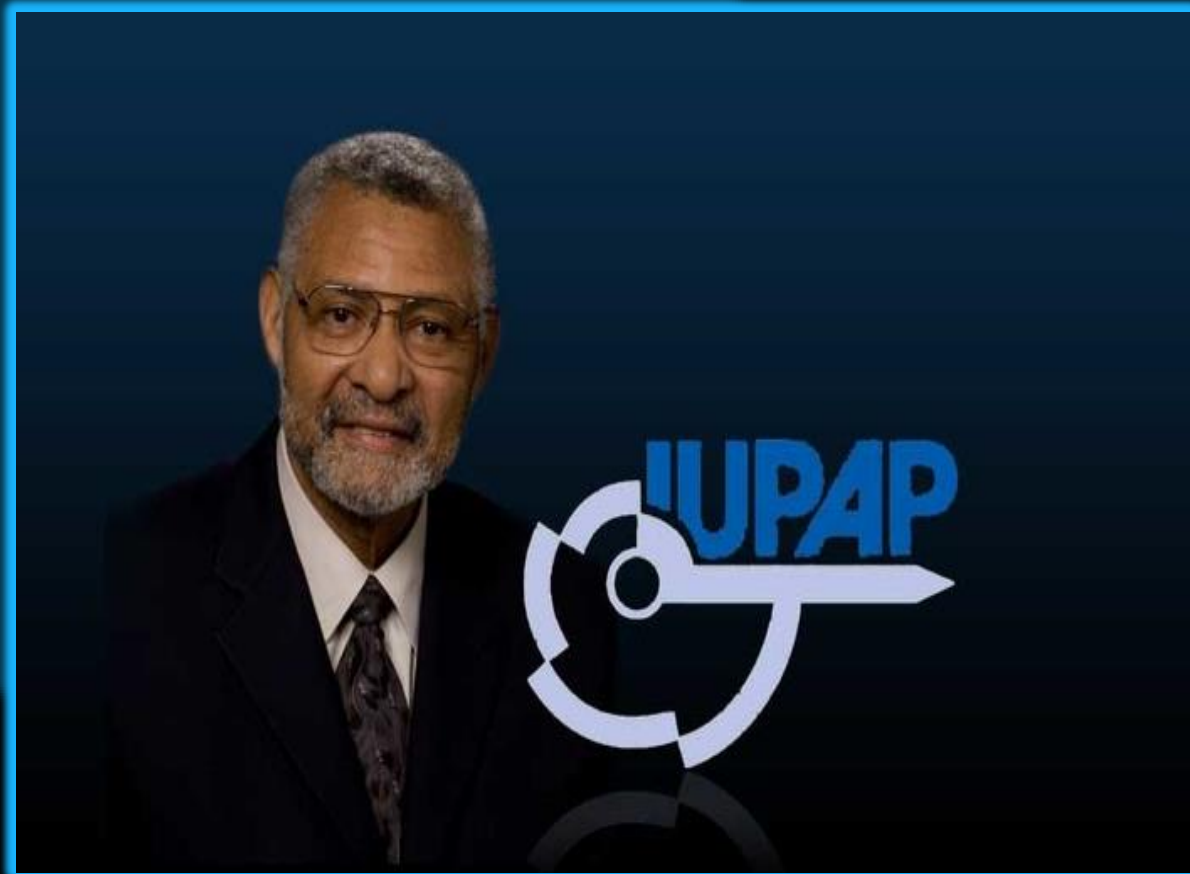


# PHYSICS MULTI-DISCIPLINARITY: THE BRIDGE TOWARDS A BETTER SOCIETY



Maaza@flabs.ac.za  
Maazam@unisa.ac.za

# ON THE FOOT-PRINTS OF GIANTS & ROLE MODELS IN PHYSICS



# PHYSICS' MULTI-DISCIPLINARITY: BRIDGE TOWARDS A SUSTAINABLE-SOCIETY

- 1- *The Nanosciences African Network (NANOAFNET)*, Founding chair), a continent-wide network of the Abdus Salam International Centre for Theoretical Physics ICTP, initiated by Prof. Maaza and launched in 2005 in Trieste-Italy. It aims to advance physics at the nanoscale throughout Africa;
- 2- *The African Laser Centre (ALC)*, Founding board member), launched in 2003. This continental network aims to advance the light sciences throughout Africa;
- 3- *The National Laser Centre (NLC)*, Founding board member), launched in 1999. This national network focuses on strengthening optics & photonics in South Africa,
- 4- *The African Materials Research Society (AMRS)*, Founding board member), launched in 2000 in Johannesburg;
- 5- *The African Solar Energy Network (ANSOLE)*, Founding board member), launched in 2011 in Linz-Austria, with a focus on advancing the physics & chemistry of materials for solar energy harvesting.
- 6- *The UNESCO-UNISA-ITLABS/NRF Africa Chair in Nanosciences & Nanotechnologies (UZACN2)*, Founding chair), launched in 2013 at UNESCO Headquarters in Paris. This platform is used to further advances in physics at the nanoscale across Africa;
- 7- *The African Centre of Competencies in Enhanced Nanosciences & Nanotechnologies for SDGs (ACCENTS)*. This platform is geared towards R&D translations and science for the benefit of the Society;
- 8- *The African Physical Society (APPS)*, Founding Member), launched in 2010 in Dakar-Senegal under the patronage of the Abdus Salam International Centre for Theoretical Physics (ICTP), Prof. Allotey (Ghana) & Prof. A. Wague (Senegal).

# CEMENTING CONTINENTAL SYNERGY VIA CONTINENTAL PLATFORMS



- LAMNETWORK-1983
- ALC-1999
- AMRS-1999
- NANOAFNET-2005
- ANSOLE-2011
- ANDi-2013
- AFPS-2010
- U2ACN2-2013
- ACCENTS-2023

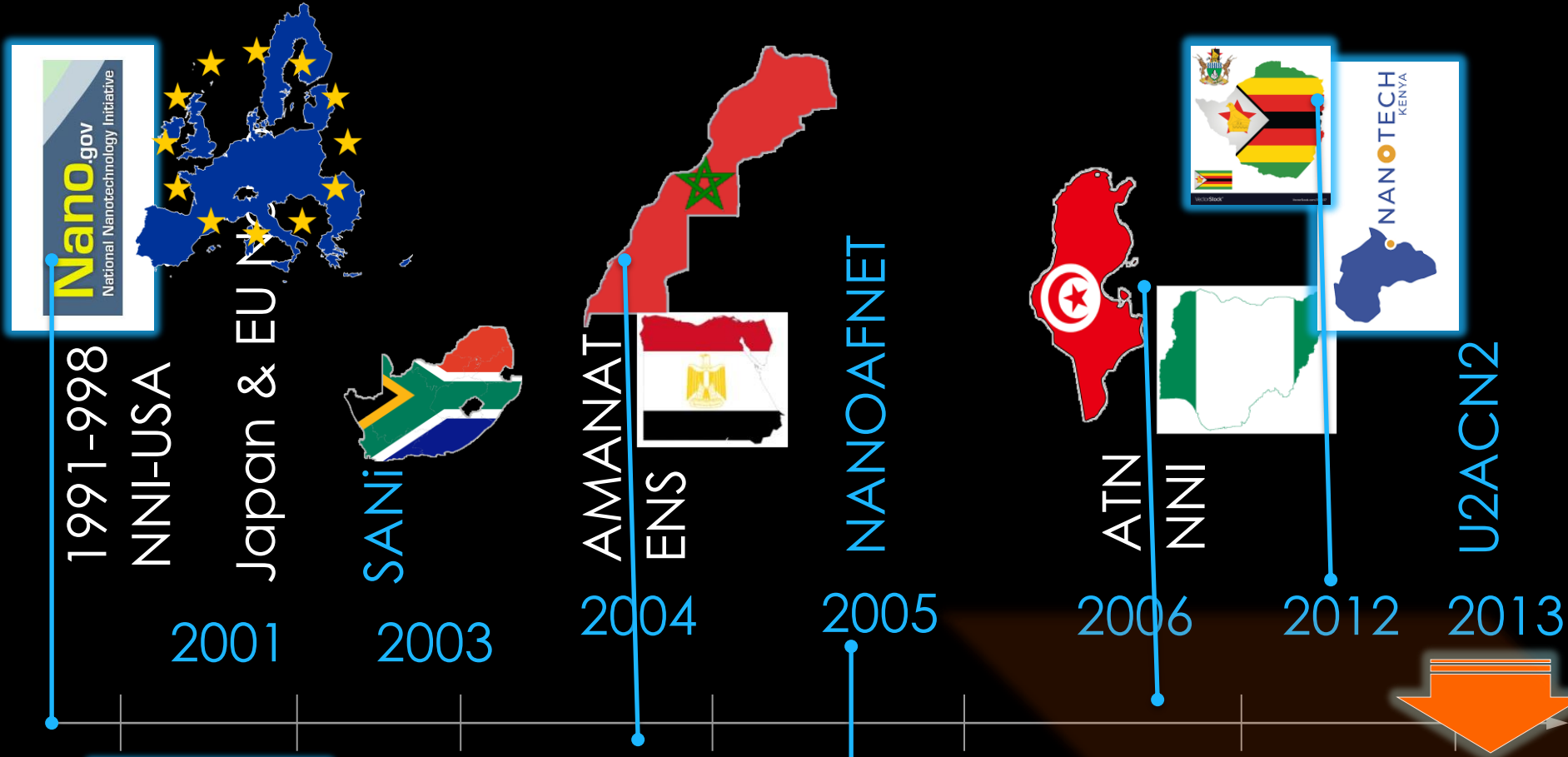


1980      1999

2012



# CEMENTING NANOFoot-PRINT ALL OVER THE AFRICAN CONTINENT



# HUMAN CAPITAL DEV.: PREPARATION OF AFRICA TOMORROW WORKFORCE

## MULTISKILLED H<sub>u</sub>man C<sub>a</sub>pital DEVELOPMENT-



65  
MSCs,  
70  
PhDs  
Since  
2005

# CONTINENTAL HUMAN CAPITAL MOBILITY:EARLY CAREER SCIENTISTS.

35  
PDPs,  
26  
Early  
career  
Since  
2005



# GENDER EQUITY IN LINE WITH SDG-5.

50%  
Female,  
50%  
Male  
Since  
2005





# TOWARDS AN AFRICAN NANO-DIPLOMA

65  
MSCs,  
70  
PhDs  
Since  
2005

UNISA   
 Stud nr: 58563016  
 Eng: M-Q Examination Coordinators  
 Tel: (012)441-5469/5509550/1/5468  
 (012)444-8646

Mr H E A Mohamed  
 Ithemba Labs  
 Material Research Department  
 1 Faure Road  
 SOMERSET WEST  
 7130  
 58563016@mvlife.unisa.ac.za

2020-11-19

Dear Mr Mohamed

I have pleasure in informing you that your thesis has been accepted for the degree of PhD in Physics, which will be awarded to you on a date to be confirmed by our Graduations division.

Please find attached a statement confirming your compliance with the requirements of the degree.

Kindly complete the following requirement(s) before graduation if you have not done so already:-

- Submit your thesis in electronic format to your supervisor who will email it to the Unisa Institute of Technology.

Yours faithfully




UNISA   
**OFFICIAL STATEMENT**

**PIERRE MWINDO KIBASOMBA**

HAS IN THE ACADEMIC YEAR 2021 COMPLIED WITH THE REQUIREMENTS FOR THE DEGREE OF

**DOCTOR OF PHILOSOPHY**  
 WHICH IS TO BE AWARDED  
 IN THE SUBJECT **PHYSICS**

TITLE OF THIS:-  
**Synthesis of TiO2 nano particles using spray Lyophilization process. Characterization and optimization of properties or photocatalytic water purification and gas sensing applications**

SAL COMPLY WITH REQUIREMENTS

1

UNISA   
**OFFICIAL STATEMENT**

**MAHMOOD AKBARI**

HAS IN THE ACADEMIC YEAR 2021 COMPLIED WITH THE REQUIREMENTS FOR THE DEGREE OF

**DOCTOR OF PHILOSOPHY**  
 WHICH IS TO BE AWARDED  
 IN THE SUBJECT **PHYSICS**

TITLE OF THIS:-  
**Synthesis and physical-chemical properties of Vertical Graphene Nanosheets (VGNs): Synthesis and physical-chemical**

DOCTORAL PROPOSAL - COMPLY WITH REQUIREMENTS

APPROVED ON: 4 FEBRUARY 2022

UNISA   
**OFFICIAL STATEMENT**

**MAHMOOD AKBARI**

HAS IN THE ACADEMIC YEAR 2021 COMPLIED WITH THE REQUIREMENTS FOR THE DEGREE OF


**DOCTOR OF PHILOSOPHY**  
 WHICH IS TO BE AWARDED  
 IN THE SUBJECT **PHYSICS**

TITLE OF THIS:-  
**Synthesis and physical-chemical properties of Vertical Graphene Nanosheets (VGNs): Synthesis and physical-chemical**


DOCTORAL PROPOSAL - COMPLY WITH REQUIREMENTS


APPROVED ON: 4 FEBRUARY 2022







*We certify that*  
**BHEKUMUZI SFUNDO KHANYILE**  
*having complied with the requirements of the Higher Education Act and the Institutional Statute, was admitted to the degree of*  
**DOCTOR OF PHILOSOPHY**  
*in Physics*  
*at a congregation of the University on 22 May 2021*





  
 Vice-Chancellor


  
 University Registrar




*We certify that*  
**MAKHANGELA CASEY MBAMBO**  
*having complied with the requirements of the Higher Education Act and the Institutional Statute, was admitted to the degree of*  
**DOCTOR OF PHILOSOPHY**  
*in Physics*  
*at a congregation of the University on 29 May 2021*





  
 Vice-Chancellor


  
 University Registrar




*We certify that*  
**HAMZA ELSAYED AHMED MOHAMED**  
*having complied with the requirements of the Higher Education Act and the Institutional Statute, was admitted to the degree of*  
**DOCTOR OF PHILOSOPHY**  
*in Physics*  
*at a congregation of the University on 20 April 2021*



  
 Vice-Chancellor

  
 University Registrar



**OFFICIAL STATEMENT**

**MAHMOOD AKBARI**



HAS IN THE ACADEMIC YEAR 2021 COMPLIED WITH THE REQUIREMENTS FOR THE DEGREE OF

**DOCTOR OF PHILOSOPHY**  
 WHICH IS TO BE AWARDED  
 IN THE SUBJECT **PHYSICS**

TITLE OF THIS:-  
**Synthesis and physical-chemical properties of Vertical Graphene Nanosheets (VGNs): Synthesis and physical-chemical**

DOCTORAL PROPOSAL - COMPLY WITH REQUIREMENTS

APPROVED ON: 4 FEBRUARY 2022

EXECUTIVE DEAN: CO  
 2022-02-08

THIS DOCUMENT IS ISSUED BY THE UNIVERSITY OF SOUTH AFRICA  
 University of South Africa  
 Private Bag 11  
 9003 South Africa  
 Phone: +27 12 429 4150  
 Fax: +27 12 429 4150  
 www.unisa.ac.za

# CONTRIBUTING TO UN-SDGs.: HEALTH-WATER-ENERGY NEXUS

**UNESCO UNISA AFRICA Chair in Nanosciences & Nanotechnology**  
(w3.u2acn2.labs.ac.za)

South Africa Pretoria



The University of South Africa  
College of Graduate Studies  
iThemba LABS  
National Research Foundation of South Africa

Headquartered at UNISA's Muckleneuk Campus in Pretoria, South Africa, the mission and vision of the U2ACN2 is to instigate and coordinate:

- (i) a continental dynamic in nanosciences and nanotechnology through a significant sustainable capacity-building,
- (ii) a robust continental human capital mobility involving HEIs in Africa & partner institutions in the north,
- (iii) cement the several fragmented African national efforts in nano in addition of addressing urgent societal needs in the water, energy and health sectors via pragmatic nano-solutions.

Prof. Malik Maaza  
Maaza@tlabs.ac.za,  
Mazam@unisa.ac.za

www.unisa.ac.za



## FURTHER NANOSCIENCES & NANOTECHNOLOGY WITHIN AFRICA VIA MULTI-SKILLED HUMAN CAPITAL WHILE ADDRESSING SOCIETAL SDGS NEEDS

### HOW THE CHAIR IS ACTING ON THE SDGS

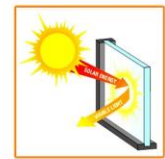
- (i) Via a Multi-skilled Human Capital Development in the multi-disciplinary field of Nanosciences/Nanotechnology,
- (ii) Via the Development of novel smart nanomaterials for solar energy applications & waste water solar based disinfection/decontamination,
- (iii) Via a novel green nanochemistry & nanomaterials design using natural extracts as effective chelating agents



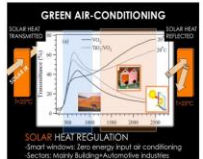
EXAMPLE 1: GREEN AIR-CONDITIONING

Biomimicking the sun heat management capabilities of the Kalahari desert Gembosbok, the smart nano-scaled Vanadium oxide coatings on glass windows allow intelligent indoor solar heat control. When it is cold, the coating is infrared

transparent and thus the coated window is transparent to the sun heat radiations.

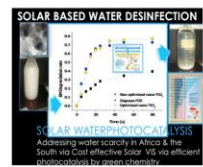


When it is hot, the coating is infrared opaque, hence the coated window blocks the sun heat radiations.



This nanotechnology is a green air conditioning with zero energy input.

EXAMPLE 2: COST EFFECTIVE WATER DESINFECTION VIA SOLAR VIS BIOSYNTHESIZED PHOTOCATALYST



Related to climate change, several African nations will be facing a severe water vulnerability if not scarcity (1000-2500 m<sup>3</sup>/person/yearly 2025). Hence cost effective water treatment technologies are required. Nanomaterials via cost effective Solar Photocatalysis is a suitable solution. The locally bio-engineered nano-NiTiO<sub>2</sub> & BiVO<sub>4</sub> via green chemistry are potential candidates for Solar water disinfection.

EXAMPLE 3: 100% GREEN NANO-CHEMISTRY & ZERO HARMFULL WASTE PROCESSINGS BY 2020

The conventional methods of the nano-synthesis most often include utilization of toxic precursors and utilize organic solvents, etc.). Therefore, green approaches for the nanoparticles synthesis are sought. One of the options is to use eco-friendly materials, e.g. plant natural extracts as effective chelating agents: Bio-Nano-Engineering.



### FUTURE ACTIONS

- (i) Achieve the 50%/50 gender target,
- (ii) Achieve the Francophone/Anglophone joint Diploma,
- (iii) Via a novel green nanochemistry & nanomaterials design using natural extracts as effective chelating agents,



- (iv) Embark in Entrepreneurship & IP culture,
- (v) Laboratory prototyping and R&D translation to address societal urgent needs: in water energy and health,
- (vi) Duplication of the U2ACN2' strategy in Africa & the South.

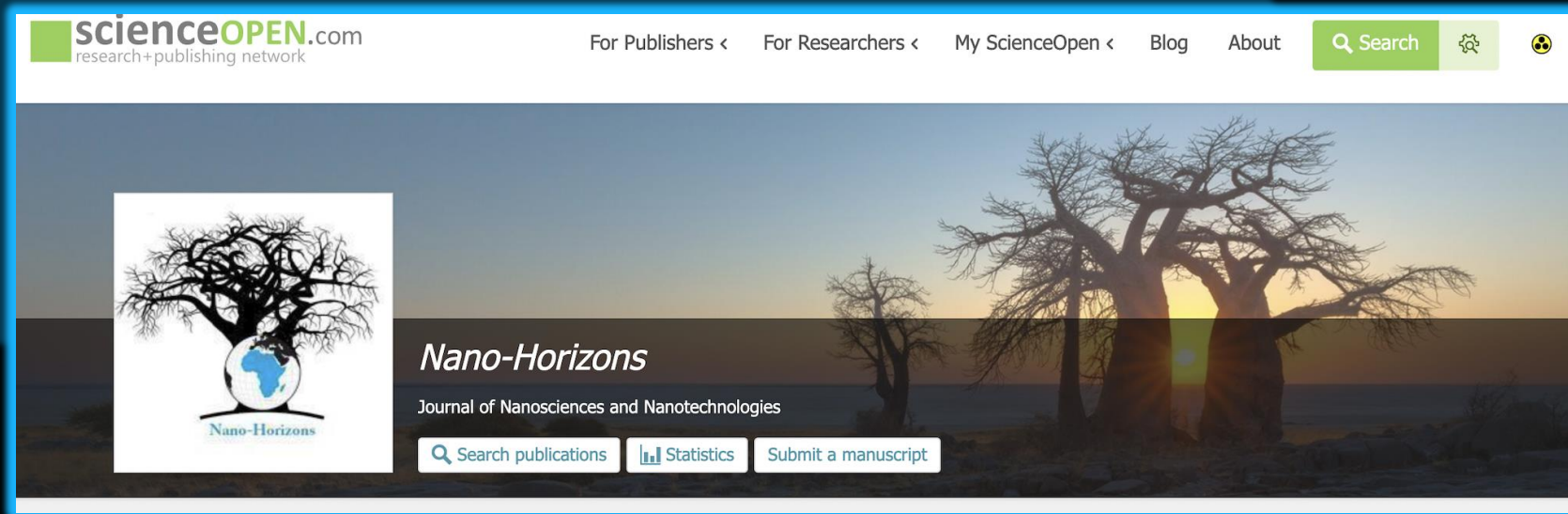


# CONTRIBUTING TO UN-SDGs.: CREATION OF AFRICA NANO-JOURNAL



- 1-<https://www.scienceopen.com/collection/523d8945-9a9a-4dbb-bcb0-944dce22118b>
- 1-UNISA Publishing House Patron & Major funder)
- 2- The Royal Society (RSoc Patron & Sponsor)
- 3- Open Science International-Germany (OSI-Patron & Sponsor)
- 4- The African Academy of Sciences (AAS, Patron)

# CONTRIBUTING TO UN-SDGs.: CREATION OF AFRICA NANO-JOURNAL



The screenshot shows the ScienceOpen.com website interface. At the top left is the ScienceOpen logo with the tagline "research+publishing network". Navigation links include "For Publishers <", "For Researchers <", "My ScienceOpen <", "Blog", and "About". A search bar and a gear icon are on the right. The main content area features a large background image of baobab trees at sunset. On the left is the Nano-Horizons logo, which depicts a tree with a globe as its trunk. To the right of the logo, the journal title "Nano-Horizons" is displayed in a serif font, followed by the subtitle "Journal of Nanosciences and Nanotechnologies". Below this, there are three buttons: "Search publications" (with a magnifying glass icon), "Statistics" (with a bar chart icon), and "Submit a manuscript".

- 1-<https://www.scienceopen.com/collection/523d8945-9a9a-4dbb-bcb0-944dce22118b>
- DOI: [10.14293/S2199-1006.1.SOR-MATSCI.CLZ9WVL.v1](https://doi.org/10.14293/S2199-1006.1.SOR-MATSCI.CLZ9WVL.v1)
- Start 2021

# FUND-RAISING & PARTNERSHIP for AFRICA & LDCs

## Funding: Institutional, External & in Kind

● Institutional: UNISA:	15,000,000.00R
● Institutional: iThemba LABS:	in Kind
● External: DAAD:	649,000.00R
● External: ADESFA:	1,700,000.00R
● External: TIA:	1,000,000.00R
● External: NRF-TWAS:	1,080,000.00R
● External: ALC:	210,000.00R
● External: INRS:	~14,000,000.00R (XPS unit)
<b>Total</b>	<b>~19,639,000.00R</b> <b>~1,296,174.00\$</b>

UNISA  university of south africa



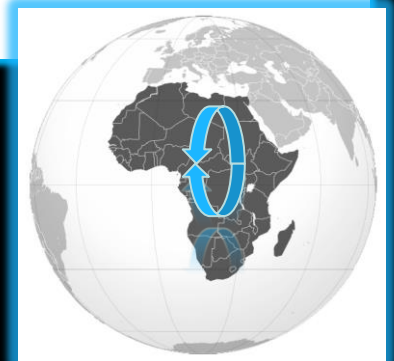
19MR

1.3M\$

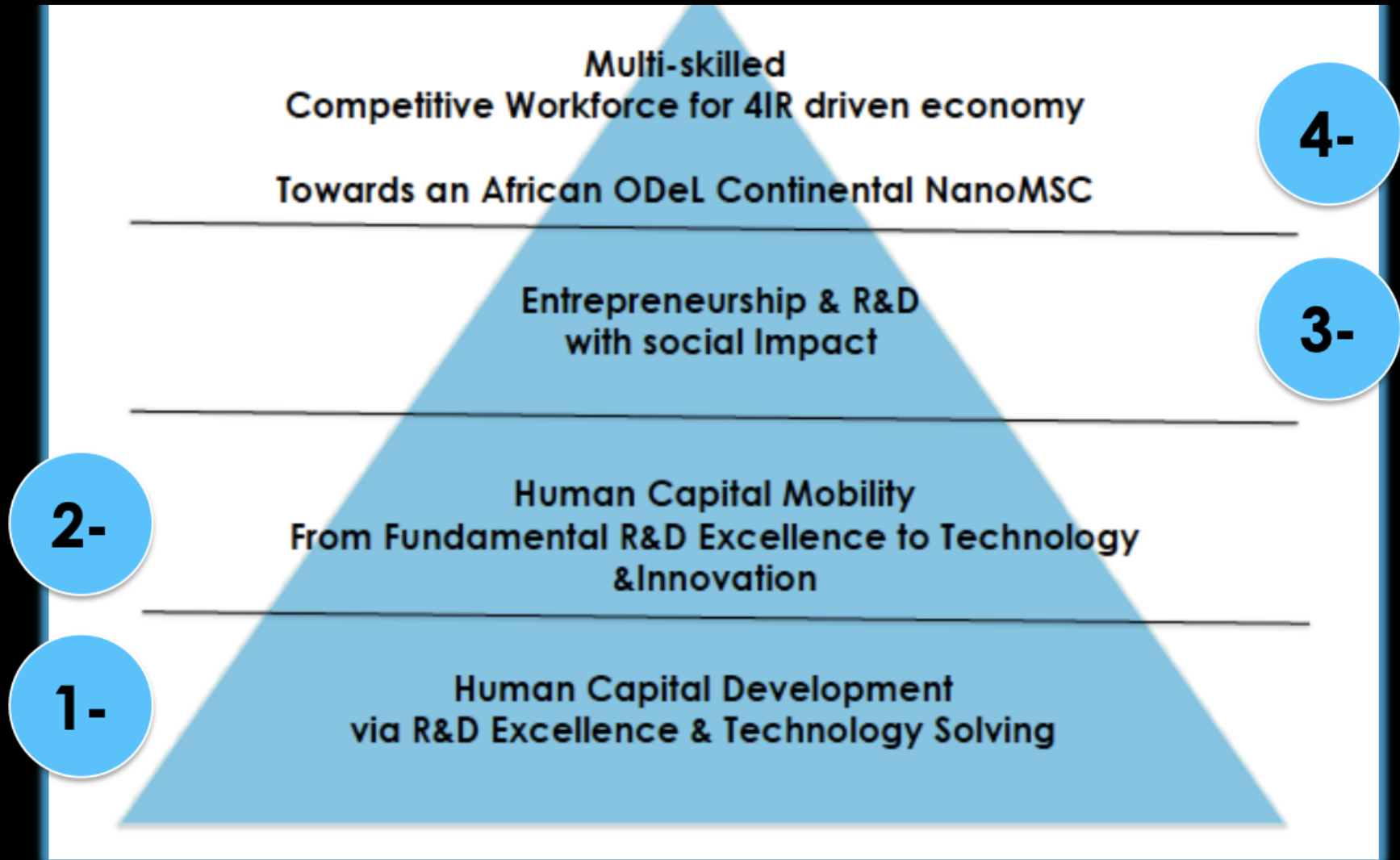


# CONTRIBUTING TOWARDS AFRICA NANO-PHYSICS GLOBAL VISIBILITY:

<https://scholar.google.co.za/citations?user=e6kaeYMAAAAJ&hl=fr>



# TOWARDS SHAPING MULTI-SKILLED PHYSICISTS & CLIMATE MITIGATION



CHUKRAN,NGIYABONGA, ENKOSI,  
MERCICI, DANKIE, KE A LEBOGA,  
ASANTE SANA,THANK YOU

